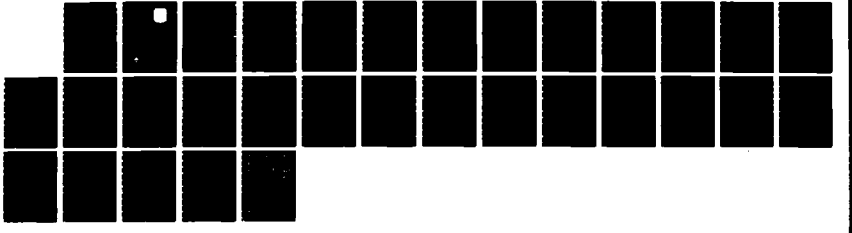
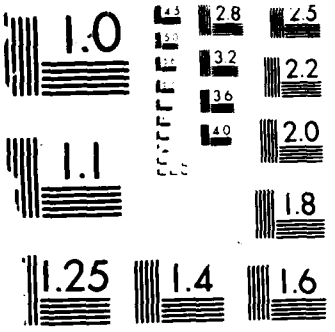
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RECORD COMMUNICATION IN THE MOBILE SUBSCRIBER ENVIRONMENT

BY

LIEUTENANT COLONEL JOHN W. BEAVER
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The Army is fielding the Mobile Subscriber Equipment communications system that will support units at Corps and below. This is the first major change in tactical communications architecture in over twenty-five years. MSE is only one of the communications means of the Army Command and Control System which consists of five elements referred to as the "Sigma Star." This system is examined with particular attention given to the elimination of the traditional record communications. Possible alternatives are explored. Data was gathered using a search of the literature, personal interviews with key Department of the Army personnel,

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US Army Signal Center personnel and individual experience acquired over forty years of cummulative experience providing tactical communications. With the fielding of these new systems it is clearly time for a change of mind set in how record communication needs are met. It is essential that command and control techniques advance commensurately with the great technological advances being made with MSE and the subsystems of the Sigma Star.



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RECORD COMMUNICATION IN THE MOBILE SUBSCRIBER ENVIRONMENT

A GROUP STUDY PROJECT

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ABSTRACT

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The Army is fielding the Mobile Subscriber Equipment communications system that will support units at Corps and below. This is the first major change in tactical communications architecture in over 25 years. MSE is only one of the communications means of the Army Command and Control System which consists of five elements, referred to as the "Sigma Star". This system is examined with particular attention given to the elimination of the traditional record communications. Possible alternatives are explored. Data were gathered using a search of the literature, personal interviews with key Department of the Army personnel, U.S. Army Signal Center personnel, and individual experience acquired over 40 years of cumulative experience providing tactical communications. With the fielding of these new systems, it is clearly time for a change of mind set in how record communications needs are met. It is essential that command and control techniques advance commensurately with the great technological advances being made with MSE and the subsystems of the Sigma Star.

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CHAPTER I

INTRODUCTION

Beginning in late 1987, the U.S. Army will initiate fielding of the most dramatic communications architecture and its associated hardware that has ever been used to provide command and control communications to Corps level units. This architecture and equipment was designed and selected to meet the needs of the AirLand Battle Doctrine, which consists of four basic tenets that must be supported by the communications system for command and control. These concepts are initiative, depth, agility, and synchronization. Basically, commanders must maintain independence of action and deny the enemy the opportunity to set the pace of battle. AirLand Battle emphasizes fighting the battle in-depth, to include the Rear Battle, the Close-In Battle, and the Deep Battle, against enemy follow-on forces. Units and their commanders must be capable of acting faster than the enemy can react and must be capable of employing all elements of combat power in a fully coordinated effort. General Donn Starry stated the essence of the communications role quite sufficiently when he said, ". . . a unit is an information processing system and the quicker and more effectively that information is absorbed, processed, and acted upon, the more effective is the unit."[1] The commander must analyze tremendous amounts of information, make appropriate decisions, and then rapidly transmit his decisions to his subordinates throughout the AirLand Battlefield.

The architecture of the Army Command and Control System, with its five functional areas and the hardware that is being deployed to support it, will meet the needs of the AirLand Battle Doctrine. However, there are new

techniques and responsibilities to be mastered and understood to ensure battlefield success. This study will examine some of these challenges and explore possible solutions.

Chapter I is an overview of the Army Command and Control Communications System and its supporting hardware systems, with emphasis on Mobile Subscriber Equipment. It examines the new systems in comparison to the currently fielded systems and doctrine. It is based on experience, a review of the available literature, and interviews with key development personnel at the Department of the Army and the United States Army Signal Center.

Chapter II examines the role of record communications in the MSE environment, where there are no provisions for communications centers for preparation, transmission, and delivery of record communications. User operated automation devices will be examined as alternatives to the traditional record communications.

Chapter III looks at the impact of MSE on various personnel in the communications hierarchy. Additionally, conclusions and recommendations are provided for consideration by users of command and control communications.

ENDNOTES

1. General Donn A. Starry, "The Application of Living Systems Theory to 41 U.S. Army Battalions," Behavioral Science, January 1985, p. 2.

CHAPTER II

TWENTY-FIVE YEARS OF LITTLE PROGRESS

This chapter will review the Army Command and Control Communications System, with emphasis on Mobile Subscriber Equipment (MSE) and how that system has evolved.

There have been few changes in command and control communications systems at the corps and division level in the last 25 years. Those communications systems consisted of an ageless "push-to-talk" FM radio system for mobile use, an often unused radio teletype (RATT) system for "hard copy" record messages, and a too hard to use high frequency (HF) radio system for long distance voice use. During those 25 years, on hilltops all over the world, signal soldiers have struggled with those systems to provide quality command and control communications. During that period, unit commanders and their staffs used hard copy message traffic on three systems. The first system was teletype messages going from one communications center to another, using the multi-channel radio systems as the transmission means. The communications centers were located at corps command posts, each division level command post, the Division Support Command (DISCOM), each brigade headquarters, and some separate battalions. The second system used for record messages was the radio teletype (RATT) system. This system consisted of two and, sometimes, three RATT nets, operations, intelligence and logistics, and provided service down to battalion level commanders. The third system was a messenger system - by foot, ground vehicle, or air - sometimes scheduled and sometimes not scheduled. The flow of a message in a corps or a division during this period

was as follows: A commander or staff officer would write the message out, longhand; a clerk would type the message in a specific format; a runner or messenger would take the message to the message center; the message center personnel would give it to the communications center; and the communications center personnel would then decide which of the three transmission means would be used to send the message.

J-SERIES TOE CHANGES

The first major changes started in 1984, with the J-Series TOE. The record message capability in both the radioteletype system and the multichannel radio system was affected. The RATT system was reduced in size, with the division losing a number of RATT terminals. The 3 division RATT nets were lost and replaced by one general purpose net with 14 stations, all provided by the division signal battalion. The change in record capability of the multichannel radio system was even more drastically affected. With the exception of communication centers at the division tactical operations center and the DISCOM, the common user communication centers were deleted from the J-Series TOE's. Communications centers associated with intelligence data systems were not affected.

Another means for hard copy record communications is facsimile. Facsimile machines have been on signal unit TOE's for years, but they are large; slow; unreliable; hard to operate; and therefore seldom, if ever, used. In 1978 signal units in USAREUR started leasing state-of-the-art, off-the-shelf, light weight commercial 3M facsimile machines. Today, these state-of-the-art facsimile machines are being leased and bought by most corps and division units. They pass their messages between machines over the common user

multichannel system and commercial telephone lines. In summary, J-Series TOE's brought about a decrease in hard copy message capability in the corps and division--a step toward the architecture of the Mobile Subscriber Equipment.

ARMY COMMAND AND CONTROL SYSTEM

After many years of wrestling with the subject of command and control communications on a battlefield that is ever-growing with today and tomorrow's technology, the Army seems to have come to grips with the problem and has set a course for all to follow. The start was functionalizing all the events that happen on the AirLand battlefield into the "Sigma Star" or five functional areas. Those areas are: maneuver control, fire support control, intelligence/electronic warfare control, air defense control, and combat service support control. Each of the five functional areas is comprised of subordinate system functions. Those subordinate systems are: the Maneuver Battlefield Automated and Manual System, the Fire Support Battlefield Automated and Manual System, the Intelligence/Electronic Warfare Manual and Automated System, the Air Defense Battlefield Manual and Automated System, and the Combat Service Support Battlefield Automated and Manual System. Each of the listed five subordinate systems is supported by many other automated and manual systems. Figure 1-1 shows the Sigma Star Functional Areas and their subordinate system functions.[1]

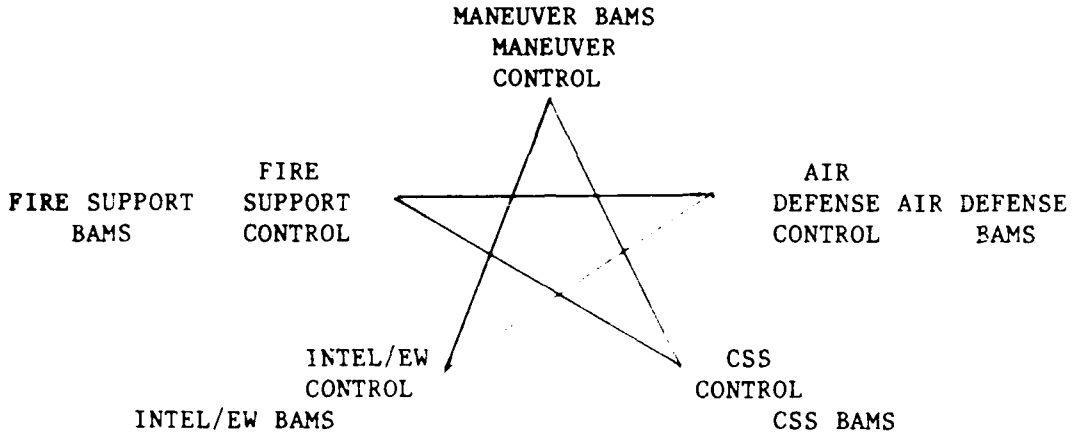


FIGURE 1-1

These systems and subsystems, automated and manual, are in various stages of development. A few are fielded, some are in production, some are in research and development, and some are in a conceptual stage. In essence, what has been described here is all of the ingredients that make up the Army Command and Control System except the means to tie it all together - the information flow - the communications transmission system.

There are three communications systems programmed to provide the transmission means to support the Army Command and Control System: the Army Data Distribution System, the Combat Net Radio, and the Mobile Subscriber Equipment System. Figure 1-2 depicts all three communications systems - interconnected - providing the transmissions means for the Army Command and Control Systems "Sigma Star."[2]

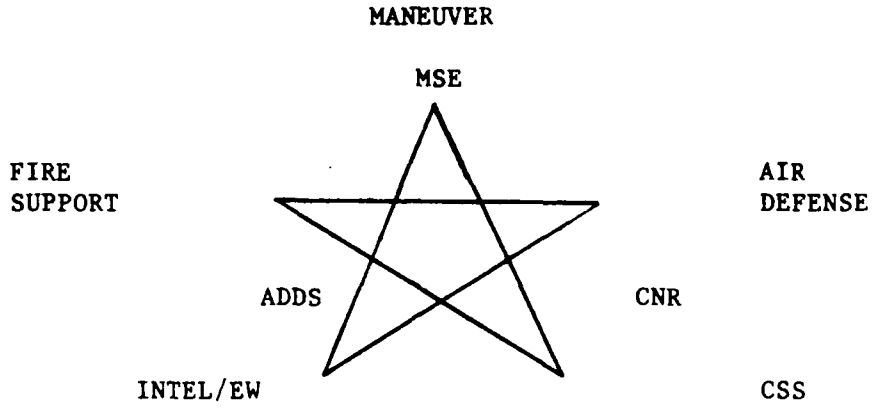


FIGURE 1-2

The Army Data Distribution System is the primary system for data users and will probably be a version of the developing PLRS-JTIDS system. PLRRS/JTIDS provides the capability for POS/NAV information, as well as passing realtime data. Combat Net Radio (CNR) is the FM radio replacement and is programmed to be SINCGARS. The Mobile Subscriber Equipment System is the primary voice system to support the Army Command and Control System. Therefore, each of the three systems has its own unique function to provide in completing the total communication system.

MOBILE SUBSCRIBER EQUIPMENT

The Army was driven to MSE because of the need to field a system with greater flexibility, mobility, transportability, and less manpower intensiveness which could be fielded in a more timely manner at less cost than the projected architecture.[3] The MSE system will replace the existing corps and divisional multichannel systems. To fulfill the timely fielding and less

cost requirements, MSE is being procured without the research and development effort normally associated with new equipment. Rather, the Army is using a non-developmental off-the-shelf approach. Two existing systems were considered, the British Tarmagen system and the French RITA system. Both were found to be good systems, however, the RITA processor was selected with the winning contractor being GTE.

MSE is an area switched system, the backbone of which consists of a series of node center switches connected by line-of-sight multichannel radio. The nodes are deployed from the corps rear boundary forward to the maneuver brigade rear area based on geographical and subscriber density.[4] The backbone system is designed as a grid network which provides for alternate communication paths between nodes. To provide communications to units not located near a major node, extension nodes connected to major nodes by line-of-sight multichannel radio are used. A mobile subscriber or a unit without an extension node uses radiotelephone via a mobile subscriber radio terminal (MSRT) to access the MSE system. MSE is a common user system designed for primary voice use, but each MSE telephone has the capability to input limited volume data and facsimile into the MSE network.

The primary subscriber terminal (telephone) used with MSE is the Digital Nonsecure Voice Terminal (DNVT). The DNVT, in addition to being a voice telephone, performs as the data interface into the MSE system, by providing connection ports for the facsimile terminal and the Single Subscriber Terminal (SST).[5]

The second subscriber terminal found in MSE is the Digital Subscriber Voice Terminal (DSVT). It is very similar to the DNVT but is designed to be the terminal device for the mobile user, used in conjunction with the Mobile Subscriber Radio Terminal (MSRT). The DVST also provides for interfacing the data devices, facsimile, and SST.[6]

The SST is a data terminal designed to be used with MSE and, as stated above, interfaces with the MSE system through the DNVT and DSVT.[7] Here is the major change in the world of "hard copy" record communication between the current system and MSE. Facsimile and the SST are the "record communication" of the MSE system. Gone is the Signal Corps message/communication center with clerks typing a message in a specific format. The Signal Corps does not own the DNVT, DSVT, facsimile or the SST - the users do. They own them, they install them, and they operate them. The users, the G-3's of the Army, are now their own message centers. The Signal Corps will give the users the knowledge of how to use the system. The SST and facsimile provide a formal and informal means of writer-to-reader record communication, and it is all user owned and operated.

ENDNOTES

1. Joe Halloran, "Command and Control Interoperability," Military Review, October 1984, pp. 41-44.

2. Interview with John Smith, LTC, Department of the Army, Office of the Assistant Chief of Staff for Information Management, October 1986.

3. United States Army Signal School, Final Draft Operational and Organizational Plan for Mobile Subscriber Equipment (MSE) System, 6 October 1986.

4. United States Signal Center and Fort Gordon, Field Circular 11-36: Mobile Subscriber Equipment (MSE)/Mobile Subscriber Grid System (MSGS) Architecture, p. 1-3.

5. Ibid, p. 5-1.

6. Ibid, p. 5-2.

7. Ibid, p. 5-5.

CHAPTER III

A CHANGE OF MIND SET

The architecture of the Mobile Subscriber Equipment communications support for the battlefield will cause a change in some of the techniques used for command and control communications. As discussed earlier, the system being deployed has no provision for traditionally provided record communications. There are alternatives available, but they will require users to change their methods of operation.

Traditionally, staffs at division and corps level have used record communications (hard copy) extensively to provide situation reports and to pass operations orders and intelligence information to subordinate and higher units. The greatest users have been logisticians and personnel administrators. During a recent major exercise in USAREUR, one of the corps experienced a record traffic level that exceeded 2,000 messages per day.[1] The available automated message terminals were saturated and the manual system of logging and delivering messages was completely overloaded resulting in a situation referred to as "the tyranny of the message center," where critical communications between commanders get bogged down and fail to be delivered in a timely, useful manner.

Several key warfighting leaders have expressed great concern over the insatiable appetite for more communications and for the proclivity to send too much information over the communications systems. When faced with the problem of overloading systems capability, the solution has been to provide more and faster systems. This has been the wrong approach, especially when combat

degradations of communications are considered. When messages are backlogged at a 60-word per minute terminal, the solution has been to provide a 100-word per minute terminal. The result is clearly explained by the "water point" story told by General Vessey.

> The most important messages from forward forces during exercises were taking too long to get to me - a distance of only forty miles. After a brief examination, I found that our message centers were jammed with too much information. In the command bunker, I saw dozens of busy people working as hard as they could on stacks of messages while crucial data for the commander's attention were held up. I went to one pile; there on top was the location of every water point in Korea. The "water point" message was typical of the messages which were plugging up the flow of critical, time-sensitive information. It was clear to me that we were not employing C^3 in a disciplined way to provide the really important data to the right people, and in a timely way.[2]

The unnecessary traffic must be reduced to allow degraded communications systems to provide the critical traffic to the warfighting commanders and staffs during war.

Many of the senior leaders of the Army are giving much thought to the problems of too much information flow. They are working to establish the essential information that will be required to make decisions at division level and above. AirLand Battle doctrine and its principles of initiative, synchronization, depth, and agility are also causing warfighters to rethink the information needs that must be met and are placing increased emphasis upon greater speed of information processing. These trends, in conjunction with the capabilities of the communications architecture in support of the Sigma Star, necessitate new doctrine for record or accountable communications.

THE PAPERLESS BATTLEFIELD

MSE constitutes a highly flexible, resilient communications architecture that will provide access throughout the corps area to those in the business of commanding and controlling corps units. However, this is only a conduit for achieving the required command and control. Each commander has a command and control system which allows him to exercise command of his forces. This system consists of "the facilities, equipment, communications, procedures, and personnel essential to a commander for planning, directing, and controlling operations of assigned forces pursuant to the missions assigned."[3] The communications aspects have been explored in-depth in Chapter II. It is not the intent of this paper to explore the essential elements of information needed by commanders for decisionmaking but to examine the alternatives to the current doctrinal approaches to providing record communications.

The most important part or aspect of the command and control system is the command operations center that supports the commander. One of the overriding goals of the system is to provide the commander with the necessary information to allow him to make decisions. It is important to recognize that the critical element of this system is the human intervention in the information process. He can be the staff officer described by General Vessey, who is inundated with information in the form of hard copy messages, or he can use state-of-the-art technology that relieves him of the onerous load of repetitive and routine operations. The widespread use of computers has clearly demonstrated their utility as work savers and decision tools, and they are used extensively in the exercise of command and control.

The potential for use of computers as tools for commanders' staffs has been recognized for many year. "A Signal Corps study in 1956 developed the architecture for Command Control Information System 1970 (CCIS-70), an Army-wide system which included subsystems for operations, intelligence, and fire support down to corps and division levels."[4] Fielding of tactical computers has been slow. The first was the Field Artillery Digital Automated Computer or FADAC which was fielded in 1962.[5] Since that time there has been much official and unofficial experimentation and use of computers to assist in the processing of information for command and control of corps and divisional units. The Army is in the process of fielding the Unit Level Computer (ULC), and USAREUR has developed a USAREUR Tactical Command and Control System (UTACC) that will tie together the USAREUR headquarters and its major subordinate commands to provide essential automation. Other major headquarters, to include Korea and III Corps, are experimenting with automation systems. The Worldwide Military Command and Control System provides an automated communications system for passing critical information from the JCS level to CINC level.

The use of microcomputers has been tested in each of the corps with systems referred to as SPADS, AIDS, and a prototype maneuver control system. Each of the evaluations used the microcomputers for transmitting graphics and other information to other microcomputers connected to a local area network and over the tactical communications system. A particularly good example of the use of small portable computers for communications was demonstrated by the 1st Infantry Division during Reforger 1986. IBM PC's were given to each divisional staff element and the major subordinate units. These devices were used for processing and storing information for decisionmaking but also served

as communications devices by using commercial communications for a local area network in Europe and to communicate with the division headquarters element remaining at Fort Riley, Kansas. Information that was transmitted was reviewed on the VDU and stored on disk, thus providing a record of traffic that could be retrieved and printed at any time. The system was capable of providing on-line printed or hard copy, as well as graphical material and data. This informal system of message transmission is called electronic mail. It is based on a software program that enables users to send text message traffic to other users who are connected electronically. Formats can be developed which allow the user to fill in the unique information and standardize the message format. Included in this can be addressees and routing or distribution information.

Perhaps the best example of the use of computers for the transfer of information traditionally sent as record communications is the TYC-ly, Automated Staff Message Center. This mini-computer has been fielded to USAREUR headquarters and the V and VII Corps. It provides worldwide access through the tactical and Defense Communications System, and it is a user operated, friendly message transmission system. The computer is housed in a standard shelter carried by a 2 1/2 ton truck. Up to six terminals are remoted from the computer to the user. The software provides for a menu driven message format which permits the user to select addressees, precedence, and other key information. This has resulted in the elimination of manual or handwritten preparation, filing, processing, and transmission of the message as described in Chapter II. It provides for efficient storage of files and flexible retrieval. Although the terminal is user operated, the software provides a system for message review and accountability. This feature is

important where message acknowledgment and accountability is essential. Some record communication is so critical that the user will rightfully demand an audit trial of the message. The Automated Staff Message Center meets this requirement.

The user terminals are positioned in the principal staff sections, and a staff officer or clerk operates the terminal. A word processing type program is provided which permits the preparation of messages on the terminal, eliminating the need for handwritten drafts that must be typed by a message center clerk. The operator can enter, edit, or store the message on the computer. Once entered, the information can be retrieved and revised, or reviewed on a monitor. The message can be released by the designated releaser into the worldwide communications system from the user terminal or simply to the other staff sections for review. The USAREUR DCSOPS staff found the system to be extremely valuable for preparation of the SITREP. The data could be entered and stored, then retrieved for update periodically. When ready for release, the SITREP could be released from the terminal. The supporting signal personnel were greatly relieved to have the critical SITREP meet deadlines without manually processing it through the message center.

Microcomputers, as user communications devices, also provide a great capability for storage of information on disks which can be electronically transmitted to addressees or, more importantly, hand carried. In the 1st Armored Division, the Unit Level Computer is being used for management of prescribed load lists, requisition, and property management. The unit inputs data into the computer and stores the information on a floppy disk. The disk is then hand carried to the DMMC on a daily basis, where it is cross-leveled

onto the DMMC computer and all supply transactions are initiated. This is an excellent system that does not rely on a local area network or other electronic communications system and may provide an excellent model for handling high density administrative and logistics message traffic in peace and war.

Clearly, microcomputers are needed for command and control information processing. Many units have locally procured and tested devices and systems, and the U.S. Army is fielding the Unit Level Computer, Maneuver Control System, and other automation systems. It is essential that these devices be used as user operated communications terminals to provide quality and timely information transfer between commanders and staffs to replace the current record copy at corps and below.

The human element of the command and control hierarchy must accept this new method of record copy communication if it expects to make timely and correct decisions and pass those decisions to subordinate leaders. Mobile Subscriber Equipment is part of the system the Army has chosen to provide this new way of sending record communications.

THE IMPACT OF MOBILE SUBSCRIBER EQUIPMENT

MSE will clearly provide a far more robust and flexible communications system than combat commanders have experienced in the past. The opportunity to communicate with the entire spectrum of the battlefield will exist. The flexibility of entering the communications scheme from any location with the same identifier and communicating secure will appear to commanders and their staffs. The capabilities of the system will tempt users to over control and over use the system, with the resultant saturation of communications assets.

This is especially true for MSE in the short term until the Army Command and Control Systems' other two components - Data Distribution System (PLRS/JTIDS) and Combat Net Radio (SINCGARS) - are fielded.

COMMAND AND CONTROL WITH MSE

One of the key command and control lessons learned from Operation OVERLORD was forced by the austere communications that were provided. Commanders, by necessity, were required to operate with mission type orders. Since units did not maintain continuous communications, it was essential that subordinate commanders knew their commander's intent. This is a lesson that all those who study the operational level of war must keep in mind.

It is important to remember this when considering the magnitude of the communications coverage provided by MSE. Commanders, operations officers, and communications officers must demand that communications assets be used sparingly in order to ensure that the systems are not overloaded and that they are available when needed for critical command and control utilization. The availability and pervasiveness of MSE will make it extremely difficult to discipline the use of the system. Since it is a totally automated system, users and many other communicators will not recognize that it can be saturated, and they may not understand it when it occurs.

An example of the saturating of an automated system occurred during a major USAREUR exercise in the spring of 1986, and the total impact on automated systems was clearly brought home to corps level communications managers. In the exercise, Corps Artillery had TACFIRE connectivity with 11 separate TACFIRE computers; the Maneuver Control System (MCS) had TCT/TCS connectivity with 7 major commands; and an automated intelligence collection

system was connected to 3 separate major commands. The results are best described by Brigadier General Al Mallette: "All were connected by TASS, common user, dial-up service - no dedicated point-to-point lines. The connections/interfaces worked well, and volumes of traffic were passed; but, typical connections lasted for extended periods - hours, at times - and the duration and number of connects essentially turned multiple common user circuits into virtual dedicated circuits. From the point of view of the network manager and the casual or normal telephone user, substantial amounts of circuitry were unavailable or out of use at any particular time."[6] He goes on to say that, ". . . data device users are gobbling up circuits and available circuit time in alarming proportions."[7] With the widespread availability of MSE, key users must ensure that communications assets are managed as a critical combat asset to guarantee its use when needed. Again, it must be stressed that, until the Data Distribution System and Combat Net Radio are fielded, MSE could be saturated with the volume and type of communications for which it was not designed.

Two command and control uses of the voice network provided by MSE must be closely monitored. Record communications, as established in Chapter II, can be provided by the Single Subscriber Terminal (SST), a data device and facsimile. Additionally, there will be data devices provided for use as command and control aids. It is essential to monitor their use to prevent them from tying up the voice network. Data devices have the capability of being extremely efficient communications users; but, if left on line, they can also lock up the common user voice circuits. Data systems must have efficient distribution software which will enable the devices to be used with minimal, efficient networking. Communications discipline will be just as critical in the MSE environment as it has been with the old architecture.

Communication Electronics Staff Officers (CESO's) in nonsignal units still exist with MSE and will have a very difficult job. The signal battalion providing MSE access to the CESO's unit command post will deliver pairs of wire to a junction box. The CESO will then be responsible for ensuring the owners of the subscriber terminals, discussed in Chapter II, have the knowledge to install and operate the terminals that they own. This installation and operation of subscriber terminals will be like the current function of driver for many soldiers, an additional duty. Here again, the change in mind set is seen, from commander down to the lowest ranking soldier.

CONCLUSIONS AND RECOMMENDATIONS

Mobile Subscriber Equipment is here; its architecture is based on requirements identified by the communication users of the United States Army. The end of the era of the traditional hard copy message is here. The evolution of that traditional means has led to facsimile and data terminal devices. Is that bad? The answer is, clearly, "no." Changing technology has provided the means to deal with the information requirements of AirLand Battle.

The system will work, but there will be some stumbling as the system is fielded and the user learns what "owning," "installing," and "operating" really mean. The key is the mind set change that must occur, and it must be top driven by the combat leaders of the Army. The writer-to-reader benefit of the SST's electronic mail option will prove to be the natural replacement of the hard copy or record communication, and the convenience of facsimile will make users quickly forget terms like "communications center" and "message center".

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4. Joseph W. McKinney, Computers for Command and Control: An AirLand Battle Report, Masters Thesis, U.S. Army Command and General Staff College, May 1984, p. 7.

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2. Interview with William Kelley, LTC, Director of Combat Development, US Army Signal Center and Fort Gordon, 2 December 1986.

3. Interview with Bob Shively, MAJ, Department of the Army, Office of the Assistant Chief of Staff for Information Management, 9 October 1986.

4. Interview with John Smith, LTC, Department of the Army, Office of the Assistant Chief of Staff for Information Management, Washington, 9 October 1986.

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